Surface Matters
What Arizonans are doing with geospatial technology
Newsletter of the Arizona Geographic Information Council

The Making of Aerial Photos

You know those seamless, color-balanced aerial photos that come up on your computer screen when you hit the right buttons? Did you ever wonder how they get there? For instance, the boss might say, "We need six-inch resolution color photography of Flagstaff." He calls an aerial photography company, some weeks go by, money changes hands, and you receive a stack of discs with high-quality images on them. So what happens between the phone call and the delivery of the discs?

Much of "what happens" depends on what the photos are for. Does your work require that you see buildings and roads for municipal planning and maintenance? Or do you need precisely referenced contours and images for an engineering project? These different requirements will determine how and when the images are collected and who supplies them.

Generally speaking, aerial photography companies are of two types, depending on how they do business. One type operates on a "photos for hire" model, while the other follows a "photos for sale" model.

As an example, Company A owns an airplane with photographic equipment. They gear their business primarily toward engineering clients who need contour data over a relatively small area for construction purposes. Because of this, they can't fly areas ahead of time; they must wait for someone to call with a specific order. Surveyed markers on the ground are used for control points, and the main product to the customer is topographic data, the contour layers that can be used for analysis and planning. The photos themselves tend to be secondary. An average job can take four to six weeks because the photo processing and contour generation must be precise. Company B, on the other hand, takes a different approach. This company doesn't own an airplane. They contract with aerial flight companies to obtain high-resolution color photos of various cities, then advertise that they have such imagery available. They do their own processing and they may specialize in value-added products like color balancing or quick-retrieval software. The keys to their success are high quality images and quick turnaround times, along with their specialized products.

Cooper Aerial Surveys' Cessna 206

What of the flights themselves, the planes and the equipment? Two Arizona companies served as the models for this article, Cooper Aerial Surveys (company A) and AirPhoto USA (company B). Their examples will give a glimpse into the world of aerial photography.

Cooper Aerial operates a Cessna, which one might think is a small and unsteady platform for producing geo-rectified imagery, but it serves perfectly well. It

continued on page 3

Inside This Issue

President's Message

Timothy Smothers
AGIC President

As 2005 comes to its fruition, we in the GIS community are realizing a common mantra throughout our profession, COLLABORATION. Collaboration, a theme presented at the AGIC conference this past October. Collaboration, the thread that binds our world of information together. The realization that we no longer live on an island, no longer exist as the "dude(ette) in the basement." Our world has better opportunity to distribute, utilize, and simply be part of the greater scope of spatial information. WOW, big ideas, large promise, and through the efforts of many geospatial professionals throughout our state, we are beginning to realize the fruits of our labors.

Within our geospatial community, we can observe a variety of efforts (some with history, some just beginning) that give meaning to collaboration. The AGIC conference has been a stellar example of collaboration, and I thank everyone involved in its development and production. This past year's conference was surely one of the best, with tracks for all walks, and a diverse mixture of papers and training that benefited all who attended. In addition to this, I have seen collaborative efforts through a variety of levels within our community: local, regional, and national.

At the local level, I see a long history of collaboration in Yavapai County (kudos to Kevin Blake), where data are freely distributed between various users, providing for a common framework within this geospatial community. I also see the efforts of Marta Dent with Maricopa County, providing opportunity for others to be part of the county's efforts to bring high quality orthophotography to our data libraries – collaboration again. Continued work within our regional councils of government, to incorporate and distribute data pertinent and essential to their missions (and our local needs) also has the great feel of collaboration.

At a regional level, the efforts of AGIC and the Arizona Professional Land Surveyors (APLS) to provide information, training, and community for all in our geospatial profession have benefited from collaboration. To that end, the efforts of Maricopa County Department of Transportation (Brian Dalager) to develop a regional GPS consortium, which could become a model for similar GPS networks throughout the state, are making a great contribution.

At the national level, AGIC is working side by side with our federal partners toward the development of a statewide imagery database. Kudos to our champions in the State Cartographer's Office (and AGIC) who spearheaded this effort working with the USGS, Census, and other agencies, to develop a plan to collect the best available data for the state to post (in the near future) to an image server for all to utilize.

Good stuff, as they say, and only getting better. It has been my pleasure to serve this past year as AGIC President, and in closing, I'd like to thank the AGIC Board for their support in all our efforts, and the geospatial community for attending our conference and other events, making them a vital component of our existence. I'd also like to welcome our new leadership, Rick Harrington (President), Tom Sturm (President-elect), and Gary Irish (perpetual AGIC Secretary) – may we continue to grow the geospatial community. ◇

AGIC Board Contacts

President
Tim Smothers
623-773-7671
tims@peoriaaz.com

Vice President
Rick Harrington
520-740-6670
rick.harrington@dot.pima.gov

Newsletter Editor

Jim Riedmann
623-773-7392
agicnews@yahoo.com

Previous issues of Surface Matters are available on the AGIC web site.

Surface Matters is the quarterly newsletter of the Arizona Geographic Information Council. It is written for those who want to stay in touch with the vision and activities of AGIC and with the continuing growth of GIS in Arizona.

Your comments about this publication are always welcome. Please send all correspondence to the editor.

Readers are invited to submit articles that they wish to be considered for publication. The author retains all copyrights. Please let the editor know if the article has been published elsewhere.

Arizona Geographic Information Council
1616 West Adams Street
Phoenix, Arizona 85007
Phone: 602-542-4060
agic@land.az.gov
http://agic.az.gov

Aerial Photos

continued from page 1

serves so well, in fact, that it's in the air five or six days a week, doing jobs in Arizona and four other Southwestern states. On board is a modern aerial film camera with a system that compensates for the forward motion of the plane, all of which is mounted in a gyro-stabilized housing. About half of the images they gather are black & white, the other half are color. They can also produce color-infrared images if a client needs them. Typically the plane will fly between 1000 and 1900 feet off the ground, obtaining imagery that is between 2/10 ft and 5/10 ft per pixel. Once the film is brought back to the office it is treated to all kinds of proprietary processing techniques to generate the contours and images and to make sure they are positioned as accurately as possible.

The story from AirPhoto USA is quite different. They don't own any airplanes, they make contracts with those who do, and as a result they get data from all over the United States. All of the photos they order are color, or color-infrared when necessary. Whereas Cooper gathers large-scale data at low altitudes, AirPhoto obtains smaller-scale data over much wider areas. The planes can range in altitude from 8400 to 10,200 ft to get 1-ft resolution images, depending on the scale required. The resolution can range from 3-inch to 3-foot, so that will have an effect on the flight altitude as well.

The cameras used could be film or digital. It turns out that film cameras have a much longer life span, on the order of 20 years, as compared to a digital camera that might need to be replaced after five years. Rob Decker of AirPhoto USA, in reference to digital cameras, remarks, "There's sensor burn and things like that involved. Physically it will wear out. There's a lot of heat generated if you're going to do it digitally, just like your computers. The bigger the processor the bigger the fan and the more cooling you need."

Another element that aerial photography must contend with is nature. The worst months of the year to fly are December and January because the sun is at its lowest and the shadows are longest. Optimum times to fly are spring and fall, especially in regions that have lots of trees. Many clients want photos in which the leaves are off the trees for maximum visibility. Other impediments include clouds or fog, smoke from wildfires, and bad weather. AirPhoto USA requires 100% cloud-free and smoke-free images, so delays are going to be inevitable.

As with Cooper, the people at AirPhoto do all of their own processing. When film is involved they get the raw film and the images are scanned, at which point they become digital. Photos from digital cameras are, naturally, already digital, so everything ends up being processed in a similar manner. The images are rectified, color balanced, and otherwise made ready for sale in a series of complex processes. Because they have data coming in from all over the country, the workload is prioritized by region and time frame.

The next time you bring those images up on your screen, think of what they went through to get there! ◊

GIS at Northern Arizona University

Those who prefer to study in the cool, forested climes of northern Arizona have a well-established GIS curriculum at their disposal at NAU.

Courses

The academic home of GIS on the NAU campus is the Department of Geography, Planning and Recreation (GPR). This is the department that offers classes and programs in GIS and operates the lab facilities. Other departments like Engineering, Biology, and Anthropology make use of GIS in some of their classes but don't teach it as a separate subject. A few new departments, like English and History, are becoming interested in the potential of the technology as well.

Nine GIS classes are offered in the GPR Department. After the introductory courses a student can go on to study such topics as project design, programming, database management systems, and environmental modeling. Separate courses are offered in raster and vector analysis. In addition, four remote sensing classes provide instruction in introductory principles, analysis techniques, instrumentation, and data gathering methods.

A few departments offer classes that make use of geographic analysis as part of their curriculum. For instance, the Geology Department has a field class in which students use notebook computers supplied with aerial photographs and GIS software. The Engineering Department teaches a surveying class that includes data gathering with GPS equipment.

Students within GPR have access to a central GIS teaching lab. The lab is equipped with 40 computer terminals, a large-format digitizing tablet, a large-format plotter, and printers for both color and grayscale output. Some professors teach their classes entirely in the lab, while others give lectures in separate classrooms and use the computer lab for software instruction. When it's not being used for scheduled classes, the lab is open for general use.

Academic Programs

Because GIS is so widely applicable on so many levels, NAU offers a complete range of related academic programs. Students can choose from four different options: an undergraduate minor, an undergraduate major, a graduate certificate, and a new interdisciplinary Master's degree, the Master of Science in Applied Geographic Information Science. All of these options are offered through the Department of Geography, Planning, and Recreation.

A minor in Geographic Information Systems requires 20 units and covers the basics of mapping and GIS. Meanwhile, three undergraduate majors are available as Bachelor's degrees:

continued on page 4

GIS at NAU

continued from page 3

a) The Extended Bachelor of Science in Geographic Information Science
b) The Extended Bachelor of Science in Applied Geography, Geographic Information Management Emphasis
c) The Extended Bachelor of Science in Public Planning, GIS & Planning Emphasis.

Next is the graduate-level GIS certificate, which is somewhat unusual in its focus. It is designed for working professionals who need to equip themselves with GIS skills. It isn't meant to be an extension of a Bachelor's program or a precursor to a Master's program. The philosophy behind it is that GIS skills are in great demand and that professionals in many disciplines may find themselves in need of such skills. As students progress through the program they gain knowledge and abilities that they can take right back to the office.

The certificate requires 18 hours of graduate-level courses and students who wish to enroll must have at least a Bachelor's degree. A student need not be in a graduate program to earn the certificate. If a current NAU student wants to enroll in the program, it is advised that he earn the certificate before enrolling in a Master's program. That way, if he wants to continue with school and earn the higher degree, he will have sound GIS skills to apply to his graduate work and can concentrate on his major subject.

Finally, NAU has the Master of Science in Applied Geographic Information Science, a new program which began in the fall of 2005. It is an interdisciplinary degree that can be taken with a thesis emphasis or a non-thesis emphasis. The thesis-emphasis program is meant for professionals who are already engaged in using GIS and/or remote sensing and is suitable preparation for pursuing a doctoral degree. The non-thesis emphasis is for students who are not using GIS or remote sensing professionally and who do not wish to pursue a PhD. A professional paper is required in lieu of a thesis.

Work Experience

Students who want to gain GIS experience while they're studying can either seek an assistanceship or an internship. Typically only graduate students become research assistants, but talented undergraduates have been known to land such positions as well. For undergraduates an internship is usually the way to go, because NAU has a very active internship program. Several agencies in the region regularly hire interns.

Students are expected to contact the organizations and set up their own programs. Some internships are paid, some are not, but all are for credit. Usually during the last week of an internship a faculty coordinator will visit the intern at the site to evaluate the experience and get feedback from the hiring organization.

Finally, in addition to everything else, a campus GIS e-mail list is available for students and teachers to exchange information.

Further Information

Northern Arizona University: www.nau.edu
Admissions, Graduate: www.nau.edu/gradcol
Admissions, Undergraduate: www4.nau.edu/uadmissions/admis/home.htm
Department of Geography, Planning & Recreation: www.geog.nau.edu
Career Center: www4.nau.edu/career

GIS Programs Coordinator
Leland Dexter, PhD, Professor of Geography

GIS Internship Coordinators
Leland Dexter, PhD, Professor of Geography
Dawn Hawley, PhD, Associate Professor

Agencies that frequently hire interns
Grand Canyon Trust
City of Flagstaff
City of Sedona
Coconino County
Arizona Game & Fish Department
National Park Service
U.S. Forest Service
U.S. Geological Survey

Tribal Groups Establishing Indigenous Mapping Network

Members of tribes from across the United States are working toward a cooperative effort called the Indigenous Mapping Network, or IMN. Still in its early stages, the IMN held a kick-off conference in March 2005 in Cartoosa, OK (near Tulsa), sponsored by the Cherokee Nation.

This new network is still growing and getting established. To that end it is planning a second conference, tentatively in the Phoenix area, to be held after March 2006. Planning and funding are still in the works, and assistance from the GIS community is being sought. If you would like to get involved with this effort, your input would be very welcome.

The IMN has put out a summary statement of its aims, part of which reads as follows:

The Indigenous Mapping Network is a group of people whose mission is to empower indigenous communities who are using or seeking information on mapping technologies. This empowerment will come in the form of education, outreach, networking, and funding.

The group is actively engaged in various initiatives to accomplish within the next year in order to establish their presence within the indigenous and mapping communities. Initiatives for 2005-2006 include:

– building a new website as a resource base
– plan for and host the 2006 and 2007 conferences
– develop relationships with potential sponsors

If interested, you may help this group progress by providing resources in the form of ideas, sponsorship, connections, or time. To get involved with the Indigenous Mapping Network or to learn more, please contact:

M. C. Baldwin
Navajo Nation
928-871-6884
mcb4gis@juno.com

See also: www.indigenousmapping.net ◇

Adding Native Place Names to the National Map

M.C. Baldwin
Navajo Nation GIS

Tribal organizations have an opportunity to provide input to the National Map (http://nationalmap.gov) by submitting Native Place Names to the Geographic Names Information System database (http://www.nsgic.org). With the help of Coeur d'Alene Tribe (Plummer, ID.), federally-recognized tribal groups can submit a list of place names each with LAT/LONG in decimal degrees, NAD83. A text file of the English translation of the native name and an audio file containing pronunciation are also required. Video of the geographic feature, language used, history of the language, and photo files can also be submitted but are optional.

The result will be for the National Map web visitors to click on a site with a native name to gain access to additional information about that geographic location. Therefore, it is important for tribal groups to obtain resolution for the official submission of these names to GNIS. This also allows tribes to assure that these sites don't have culturally significant structures or other items that might be defaced or destroyed by visitors to the sites. For sample resolution or information on file formats, contact Coeur d'Alene Tribe at (208) 686-5307, ATTN: Frank Roberts, *fmroberts@cdatribe-nsn.gov*. ◇

Contributors

M. C. Baldwin, Navajo Nation
GIS-Systems Analyst

Mary Cook-Hurley, AirPhoto USA
Government Relations

Rob Decker, AirPhoto USA
Director of Marketing

Leland Dexter, PhD, Northern Arizona University
Pofessor, Dept. of Geography, Planning & Recreation

David Major, Cooper Aerial Surveys
Project Manager

AGIC Roundup

• In its November meeting, the AGIC Board elected Tom Sturm as President-Elect and Gary Irish as Secretary for the coming calendar year. Congratulations to both!

• AGIC Board officers will be meeting in January to discuss the 2006 Work Plan. The plan is a set of projects and goals that AGIC will pursue during the year. Its main focus points will be incorporated into the next edition of *Mapping Arizona.*

• The 2005 AGIC conference was a great success with 265 attendees. In 2006 the annual ESRI Southwest User Group (SWUG) meeting will be held in Arizona, and as a consequence there will be no AGIC conference next year. Members of the AGIC Conference Committee will be helping to arrange the SWUG meeting. Updates about SWUG will be available through this newsletter, the AGIC listserve, and on the AGIC web site.

• The Microcomputers in Education Conference (MEC) will be held at Arizona State University in March 2006. GIS will be a major component of the conference and the AGIC Education Working Group will be involved. AGIC will also provide $1500.00 to ASU in scholarship money to allow presenters and Arizona educators to attend.

• Work is progressing on the Arizona Imagery Project. Funds for the imagery have been collected and the images are expected to be delivered in late December. A server for the imagery still needs to be acquired, and two sites to house the server are under consideration. Once in operation, the server will contain new aerial photography that was flown in the summer of 2005. The new photographs will cover all of the state except Maricopa, Pima and Cochise Counties.

Calendar of Events

AGIC Quarterly Board Meeting

Thursday, February 2, 2006

10:00 AM

Location to be announced

http://agic.az.gov/board/meetings.htm

Microcomputers in Education Conference

March 11-13, 2006

Arizona State University

http://mec.asu.edu/2006

Arizona Professional Land Surveyors Annual conference

March 23-25, 2006
Tucson convention Center
260 S. Church Ave., Tucson, AZ
http://www.azpls.org

The **Northern Arizona GIS User Group** has a new home in cyberspace! You can find them at http://groups.yahoo.com/group/NAGIS_Users
Their next meeting will take place in March 2006, time and place to be announced.
Contact: Aaron Seifert, aseifert@swiaz.com

The Arizona chapter of the **Society for Conservation GIS**, based in Tucson, has disbanded. Information about the national society can be found at www.scgis.org.